THE WESTERN AUSTRALIAN
NATURALIST

Vol. 3 JUNE 20, 1952 No. 5

A CRATER-LIKE DEPRESSION NEAR MINGENEW, WESTERN AUSTRALIA

By M. CARRIGY, A. MAIN and B. MARSH.

INTRODUCTION.

While inspecting a series of aerial photographs of the Mingenew district taken for the Lands Department, one of the authors, B.M., was struck by the occurrence of an isolated circular depression showing on the photographs of Pintharuka, Run 10, Nos. 5058 and 5059 (see Fig. 1). Impressed by the symmetry of the depression, the rim (which showed clearly when viewed with a stereoscope), and the fact that other similar depressions did not occur in the vicinity, the discoverer tentatively suggested that the feature owed its origin to the impact of a large meteorite.

Although the photo discovery was made in 1950 no opportunity of visiting the area presented itself until March 14-15, 1952 when the writers were able to make a brief visit to the site.

The depression is located on the property of Mr. A. Ewers, about 18 miles east and 1¾ miles south of Mingenew on south boundary of Location 2016.

On our arrival Mr. Ewers visited "the swamp," as he called it, with us, and explained that in very wet winters the depression was filled to a depth of 4 feet with standing water which collected from the surrounding drainage area of several square miles. The water, however, did not persist but drained away by "soakage" within a few weeks. This first view of the area in the company of the owner clearly showed that the depression was not caused by a meteor for the rocks of the country, where exposed, were not tilted or shattered and the remainder of the rim was of a red sandy soil lightly covered with scrub.

Unexpectedly, the rock exposed here was limestone and this coupled with the local drainage pattern would seem to indicate a cause and effect relationship with the "crater", the prevailing winds contributing to the formation of the "rim" of sand which is about 5 feet above the level of the surrounding plain.

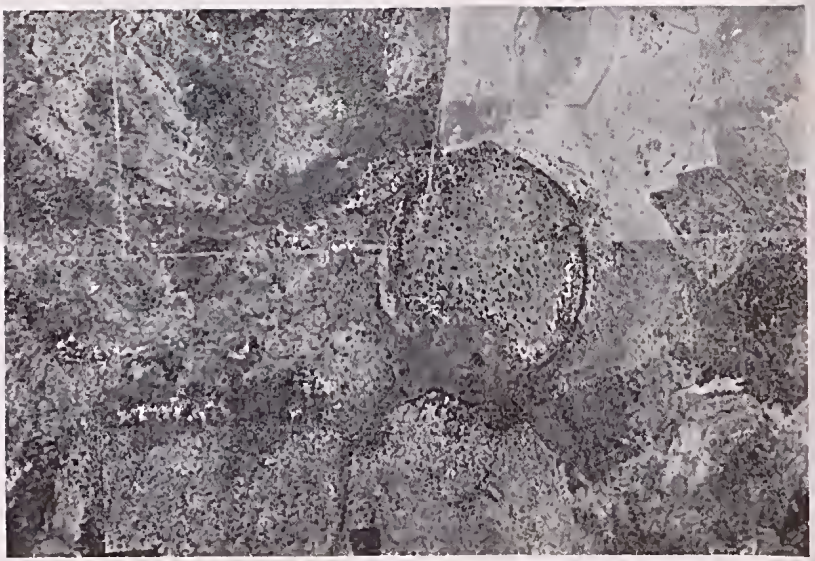

Fig. 1.—Pintharuka, Run 10, No. 5058.

Vertical aerial photograph of the depression. Note the contrast in the density of the vegetation inside and outside of the depression.

This photo is reproduced by courtesy of the Chief Draftsman, Lands Department, Perth.

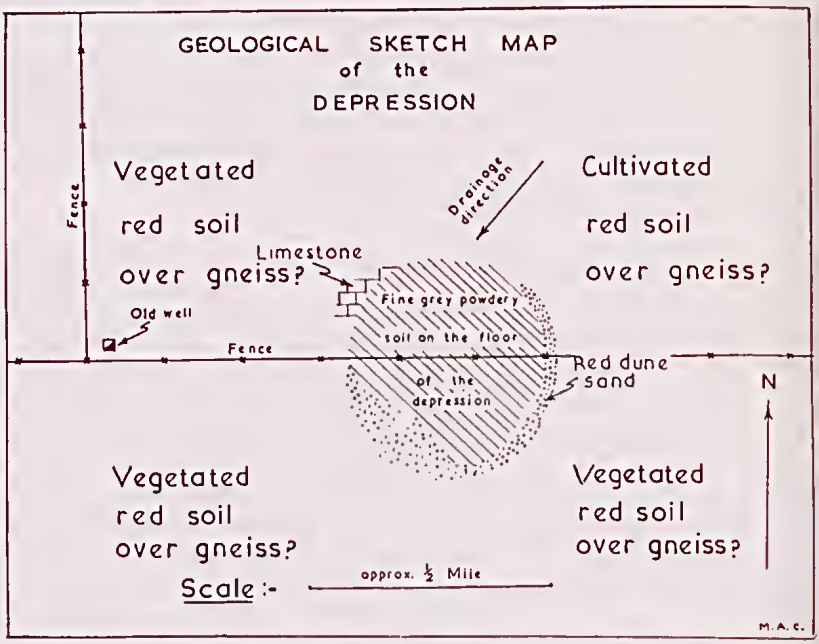

Fig. 2.

PHYSIOGRAPHY

The area lies within the 16-inch rainfall belt, most of which falls in the winter months. The depression under discussion lies in a shallow saucer-shaped basin. The general topography is of a subdued mature nature. From a distance the depression appears as a slight rise, this is because the only tall vegetation in the area *(Eucalyptus rudis)* occurs within the depression and the tops of these trees show appreciably higher than the surrounding shrub of *Acacia sp.* and occasional mallees. The rich red soil of the plains is underlain by gneiss, kaolinised to varying depths, and other easily eroded rocks, with a few resistant ridges of quartzites and silicified conglomerate and some mesas and buttes capped with ferruginous "plateau beds." The regional drainage is to the west.

GEOLOGY

Fortunately during our geological reconnaisance we had access to a mosaic of aerial photographs of the area, which Mr. Ewers had purchased from the Lands Department.

The area was surveyed in 1910 by W. D. Campbell of the State Geological Survey who had been mainly concerned with the sedimentary basin to the west and paid little attention to the Pre-Cambrian areas with which this paper is concerned. The geology of the surrounding country is masked by superficial soil deposits and outcrops are widely scattered. However, Mr. Ewers kindly drove us to the critical outcrops and with the help of mosaics we were able to interpret the geological structure in general terms in the following manner:—

A series of closely folded metasediments (silicified conglomerate, quartzites, phyllites, etc.) and gneiss, having a north-south strike with the folds possibly pitching to the north.

These rocks are undoubtedly Pre-Cambrian in age and can perhaps be correlated with the Jimperding series of Clarke (1930). The northern continuation of the great Darling Fault can be clearly seen on the mosaic 2 to 3 miles west of the depression. This fault separates the older Pre-Cambrian to the east from younger Pre-Cambrian, Permian, and later sediments to the west. These extend to the coast and are the southern part of the beds of the Irwin Basin (Clarke, *et al,* 1951). Traces of a possible fault parallel to the main fault approximately two miles to the east of the depression can be made out in the mosaic but it is obscured on the ground by cultivation and proof of existence required much more time in the field than was available. The older kaolinised gneiss is overlain in this area by a thin bed of limestone already mentioned in the introduction. The resistant hills are capped with iron-rich plateau beds.

The important rock from our point of view is the thin bed of limestone. It is only a few feet thick and is a calcareous "B" horizon of the soil. An old well put down half a mile to the west of the depression is said to have passed all the way through limestone

to a depth of 60 feet where good water was obtained. Much foul air was encountered in cavities in the rock as this well was being sunk. The rock from this well, now lying on the surface, consists of limestone and some fragments of kaolinised sheared gneiss.

TENTATIVE EXPLANATION

As has already been mentioned in the introduction the depression receives the drainage from a large catchment. The difference in altitude within the catchment is very slight, consequently the run off passes by as a series of ill-defined watercourses to the lowest part of the depression. This is the circular depression with which this paper is concerned. This water drains from the central depression by soakage and in doing this has probably dissolved the limestone basement so deepening the depression. While water drains underground the central depression will continue to grow in size. The depression itself is floored with a fine grey powdery soil, and limestone outcrops on the north-western rims (see Fig. 2). Three-quarters of the margin consists of vegetated sand dunes. A study of the quartz fraction of the dune sand shows a high percentage of well-rounded frosted grains. These could only have been formed by wind abrasion while passing through a long series of erosion cycles, and are therefore not modern. A theory accounting for the origin of this depression is that a standing body of water accumulating from a drainage basin of several square miles has dissolved out a depression in the underlying limestone and a series of dunes have been built up around the water by wind. Similar depressions are common on the great plains of Kansas (Frye, 1950).

SUMMARY AND CONCLUSIONS

Since there are no tilted or shattered rocks (Lobeck, 1939) there is no evidence of a meteorite having formed this depression. The writers believe the origin to be the result of the surface and underground drainage pattern eroding a circular depression in the thin limestone bed by solution; wind has then formed dunes around the edge.

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